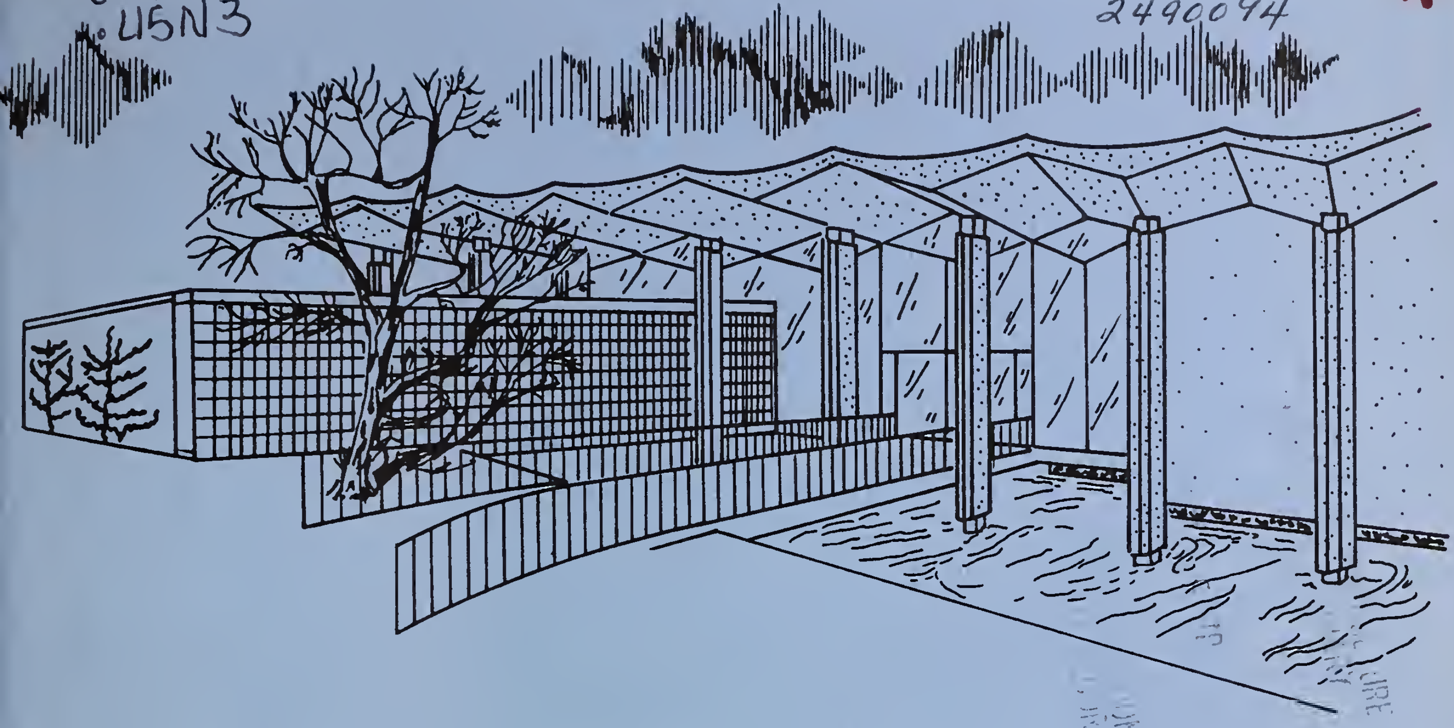

U.S. NATIONAL ARBORETUM

ANNUAL REPORT

1977

SCIENCE & EDUCATION ADMINISTRATION
U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

U.S. National
Arboretum

U.S. DEPARTMENT OF AGRICULTURE
SCIENCE AND EDUCATION ADMINISTRATION
Federal Research
U.S. NATIONAL ARBORETUM

DIRECTOR'S OFFICE

John L. Creech, Ph.D.; Director
Doris M. Thibodo; Secretary to the Director
Nancy M. Cronin; Budget and Personnel

FACILITIES AND MAINTENANCE

M. W. Scarborough; Manager
Thurman J. Dade; Maintenance Supervisor
Margaret E. Brady; Procurement

EDUCATION, INFORMATION AND LIBRARY

Erik A. Neumann, M.S.; Horticulturist, Curator of Education
Mary Ann Jarvis; Education Assistant
Jayne T. MacLean, M.S.; Librarian

PLANT COLLECTIONS AND PLANT EXCHANGE

Sylvester G. March; Horticulturist
Vacancy; Plant Propagator
Loring I. Benedict, B.S.; Greenhouse and Gardens
Robert F. Drechsler, B.S.; Curator, Bonsai Collection
Robert F. Doren, B.S.; Curator, Gotelli Conifer Collection
Ronald L. Bare, B.S.; Curator, Azalea-Rhododendron Collection
Ernest J. Luskey; Curator, Camellia Collection
Lynn R. Batdorf, Curator, Boxwood-Daylily Collection
Craig T. Keys; Gardener-in-Charge, Fern Valley
James A. Rogers; Gardener-in-Charge, Dogwood Collection
Robert Woodard; Gardener-in-Charge, Administration Building Gardens
Junior A. Peterson; Maintenance Gardener
Moses J. Bishop; Plant Labeling and Signs

ARBORETUM RESEARCH

Nomenclature and Taxonomy of Cultivated Plants

Frederick G. Meyer, Ph.D.; Taxonomist, Curator, Arboretum Herbarium
Theodore R. Dudley, Ph.D.; Taxonomist, Curator of Type Collections
Roland M. Jefferson, B.S.; Botanist
Peter M. Mazzeo, B.S.; Botanist
James McClammer, B.S.; Herbarium Assistant

Cytogenetics, Breeding and Evaluation of Shade Trees

Frank S. Santamour, Jr., Ph.D.; Research Geneticist
Gene K. Eisenbeiss, B.S.; Horticulturist
Harold E. Vettel, B.S.; Biological Technician (Biochemistry)

ARBORETUM RESEARCH

Cytogenetics, Breeding and Evaluation of Ornamental Shrubs

Donald R. Egolf, Ph.D.; Research Geneticist
Anne O. Andrick; Research Technician

Ornamental Introduction, Evaluation and Development

William L. Ackerman, Ph.D.; Research Horticulturist
Margot Williams, M.S.; Horticulturist

Plant Introduction Station, Glenn Dale, Maryland

Howard E. Waterworth, Ph.D.; Virologist

COOPERATIVE SERVICES

National Capital Area Federation of Garden Clubs, Inc.

Mrs. Robert J. Westbrook; President
Mrs. George Lahr, Federation Hdqtrs. and Garden Center
Mrs. Judson C. French; Chairman, Guide Service
Mrs. Gerald Rockelli; Activity Center Gift Shop

Friends of the National Arboretum

Frank P. Cullinan, Ph.D.; Trustee
Mrs. Benjamin A. Powell; Trustee
Henry T. Skinner, Ph.D.; Trustee

Arboretum Collaborator

Henry T. Skinner, Ph.D.

NATIONAL ARBORETUM ADVISORY COUNCIL
July 1976 - July 1978

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Princeton, New Jersey

Dr. John P. Mahlstede, Vice Chairman
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Watertown, Massachusetts

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Silver Spring, Maryland

Dr. Fred B. Widmoyer
Las Cruces, New Mexico

Mr. John B. Wight, Jr.
Cairo, Georgia

REPORT OF THE U.S. NATIONAL ARBORETUM
for the period January - December 1977

prepared for the meeting of the
Advisory Council
May 25-26, 1977

INTRODUCTION

The National Arboretum entered the second half century of its existence on March 4, 1977. It is gratifying that this has been accompanied by a history of marked accomplishments in research, steady progress in the development of facilities, and an increasing amount of public awareness of the National Arboretum. The acquisition of the 32-acre "brickyard" on New York Avenue and the development of a Master Plan that assigns this new property to the Main Entrance and for public education and services are perhaps the salient factors that will govern the course of our development during the next 50 years. Just as the efforts of the individuals who managed our past growth created the National Arboretum of today, the deliberations and actions of the present managers and advisors will define the nature of the National Arboretum as it is viewed 50 years down the road.

The National Arboretum is one of the largest of public arboretums within metropolitan confines and is the only Federal institution of its kind with national responsibilities to the public. The combined Congressional mandate of research and education anticipates that the National Arboretum will serve our entire plant-oriented public including nurserymen, home-owners, city planners, our educational system at all levels, and the scientific community. We have already established the National Arboretum as the leading institution in the development of improved trees and shrubs for the above groups and in the quality of the genetic and botanic research supporting these ends. We will, in the future, need to bring the quality of our educational services to a similar level if people are to benefit from the full nature of the Arboretum. This requires the kinds of facilities and personnel that are envisioned in the Master Plan. For this reason, a special responsibility has been placed on the public administrators and their private sector supporters if the National Arboretum is to succeed in meeting the mandates envisioned at the time of its creation in 1927. The means whereby our Master Plan can be implemented in the next few years must be acquired or we will be immobilized between the successes of the past and the exciting potentials of the future.

ARBORETUM ADMINISTRATION

A. Organization

The Department of Agriculture has established a new organization, Science and Education Administration (SEA) which brings together under one Director programs previously separated. Under the Director for Science and Education, the programs of the Extension Service, the Cooperative State Research Service, the Agricultural Research Service, and the National Agricultural Library have become Extension, Cooperative Research, Federal Research, and Technical Information Systems under four Deputy Directors. Mr. T. W. Edminster, our former ARS Administrator, is the Acting Deputy Director for Federal Research. Dr. James Nielson is Interim Acting Director for Science and Education. The Director, SEA, reports to Dr. M. Rupert Cutler, Assistant Secretary for Conservation, Research and Education.

As far as the National Arboretum is concerned, the new organization does not change lines of authority, and we report through Dr. James Dogger, Director, Chesapeake-Potomac Area, to Dr. Steven C. King, Acting Regional Administrator for Federal Research.

B. Operating Plan Budgets

The initial FY 1977 Operating Plan Budget for salaries and support services was $1,505,900. During the fiscal year, this was increased by $151,700 by the Regional Deputy to provide for major items of repairs and maintenance. In addition, $79,000 was provided from ARS and NER reserves to undertake a Master Plan for submission and approval by the National Capital Planning Commission. Despite efforts to operate within our allotted budget, energy costs for FY 1977 far exceeded what we planned. Total costs for electricity, gas, telephone, and fuel amounted to $111,335 (47 percent of our total budget for services). This expenditure is an increase of $34,200 over our 1976 energy costs.

The initial FY 1978 Operating Plan Budget was $1,589,500 which represents an increase in salary costs but not additional funds for support services. However, the Regional Deputy has provided $52,000 for much needed interior renovations to the Administration Building and repairs to the pool around the Administration Building.

C. Developmental Activities

The temporary entrance from New York Avenue through the "brickyard" opened on April 17, 1977, and has been used increasingly throughout the year. This aspect of the brickyard purchase fulfills our obligation to the local citizens to relieve the vehicle pressure on residential "R" Street.

In conjunction with the Master Plan process, a Task Force was established by the National Capital Planning Commission (NCPC) with representation by NCPC, National Park Service, D. C. Planning Office, Arboretum Neighborhood Association, Upper Northeast Coordinating Council, local business representatives, and the Arboretum. The purpose of this body is to provide for inputs by impacted agencies and community groups as the Master Plan develops. By this means, there will be no surprises or overlooked concerns when the Master Plan is submitted to the NCPC for approval. The major outside interest relates to the future development of the "brickyard" and the impact that increasing public visitation to the Arboretum will have on the surrounding community.

On July 21, 1977, the Joint Committee on Landmarks gave approval to the nomination of the "brickyard" for the National Register of Historic Places. The inclusion of the "brickyard" results from the fact that the National Arboretum is already on the National Register and the "brickyard" is now an integral part of the Arboretum.

The Director presented the plans for the National Herb Garden to the National Capital Planning Commission (NCPC) and received approval for the project at the NCPC meeting on December 1, 1977, with only a single minor deletion of an access walk. The NCPC called the plans "imaginative and exciting." In addition, the Advisory Council on Historic Preservation approved the plans, thus clearing all requirements for the construction.

The National Herb Garden, a cooperative project between the Herb Society of America and the National Arboretum is moving along remarkably well. The construction plans are 95 percent completed. The Society is making a concerted drive to raise construction funds and has accumulated over $200,000 through donations. The rough estimate for the construction and fine finishing of the garden is approximately $400,000.

With the site and plans now approved by the NCPC, the Northeastern Regional Engineering Office is laying out the grading lines and other preliminary engineering details so that Arboretum staff, under Mr. Scarborough, can undertake the rough grading once the total funding for the garden is assured. In addition, the staff of the Arboretum, with members of HSA and the architect, are selecting tree and shrub species with herbal connotations to enhance the herb garden.

The project on the Legendre Deciduous Shrub Garden (Plants in the Landscape) continues in abeyance until the Master Plan is approved However, a preliminary design concept has been drawn and will be incorporated into the Master Plan. Preliminary discussions have been held with the Audubon Naturalist Society of the Central Atlantic States for the eventual development of a collection of shrubs that will attract birds. A site near the old Braille Trail has been selected as a most likely place to attract birds.

We are still working on a new site for the Braille Trail but this entails an in-depth relationship with organizations serving the handicapped to discover the true nature of the interests of blind persons for a natural area.

As a result of funds provided by the Regional Deputy, the last two plastic greenhouses were contracted for erection. With the completion of this process, we will now have five 96' x 26' plastic houses for the research program. Rather than discard the old smaller plastic house frames, the three units were moved to a new location and assembled as two units which provide winter protection to large specimens prior to their movement to the permanent plantings.

Along with the erection of the new plastic houses, the entire electrical system for the main greenhouses has been renovated and heating is being installed in all of the large research plastic houses. Details of major improvements to other facilities are described elsewhere in this report.

D. Friends of the National Arboretum

The National Arboretum Gift Act which was incorporated by Congress into the original Act of March 4, 1927, is beginning to have its effect. Funds placed in this special account by the Herb Society ($17,776) have provided for the plans required in our submission to the NCPC and similar items essential to the preliminary planning stages for the National Herb Garden.

Funds totaling $39,000 plus architectural design were presented to the Arboretum under the Gift Act to construct a sitting area and overlook in Cryptomeria Valley. This exceptional contribution to the increasing beauty of the Anacostia River section of the Arboretum will provide for a great pleasure to the visiting public. The two benches cut and crafted by Arboretum staff from a large white oak felled by lightning is the Arboretum's contribution to this overlook.

Mrs. Retha Walden Gambaro, Sculptor of Washington, D.C., presented the Arboretum with a bronze "mermaid" for installation in the pool surrounding the Administration Building. This wonderful piece of art will be installed when the pool is emptied and cleaned in the spring of 1978. Mrs. Gambaro made the gift in appreciation for the contribution of the National Arboretum to the beauty of Washington.

Among the major contributions to the Friends of the National Arboretum in 1977 was the exceptional sum of $1,490 from the Woman's National Farm and Garden Association to further the purchase of trees and shrubs for the Francis King Dogwood Garden. The WNFGA was responsible for the initial creation of the garden and, over the years, has provided funds for the purchase of trees, benches, shelters, and the central fountain.

Total contributions from many sources in 1977 amounted to $12,124.19. Expenditures for the same period amounted to $20,608.10.

E. Personnel Operations

Personnel - The personnel strength of the Arboretum has been reduced from 83 to 80 full and part-time positions and student employees. Among the losses is a professional position resulting from Mr. Robert Pryor's mandatory retirement.

In 1977, we again were fortunate to operate a Youth Conservation Corps camp. Thirteen youth from Metropolitan Washington were employed under supervision of two technical leaders. All were exceptional young people and accomplished several major renovations in the Fern Valley and Cryptomeria Valley locations.

Training. During the year, 29 Arboretum employees took formalized training ranging from seminars to college level courses aimed at improving work skills. A significant training was in pesticide management so that employees could be certified by the District of Columbia government in the application of pesticides.

Awards - Dr. Creech received the Department's Superior Service Award for his leadership in the development of the National Arboretum. Also, the 1977 Recognitions Award from the Woman's National Farm and Garden Association "in appreciation of his sense of unity and loyalty to the continued development of the National Arboretum."

Dr. Egolf received the Jackson Dawson Medal of the Massachusetts Horticultural Society for 1977. This honor was bestowed for his scientific accomplishments in plant breeding and selection of outstanding cultivars of Viburnum, Pyracantha, Lagerstroemia, and Hibiscus.

F. Facilities

There have been a number of improvements in Arboretum facilities. Following are the major items which have either been completed, or for which contracts have been placed.

1.	Replacement of all electrical wiring and gas lines plus new heaters and air coolers in the plastic greenhouses	$37,378.00
2.	Contracted and installed 2 new Gro-Mor plastic greenhouses 96' x 26'	8,729.92
3.	Relocated 2 old plastic greenhouses, installed electric and gas lines (Arb. personnel, completed)	0
4.	Contracted for new asphalt surface in maintenance shop area (completed)	7,210.00
5.	Contracted for new irrigation system in the plastic greenhouse range	12,399.00

6.	Contracted for drain field for the 2 new plastic greenhouses	$ 4,030.00
7.	Contracted for cinder block walls and concrete walks in plastic greenhouses	10,644.00
8.	Installed water lines to 2 relocated greenhouses (Arb. personnel)	0
9.	Purchased on special Repair & Maintenance money, galvanized pipe for installing new irrigation lines	10,000.00

Vehicles and Heavy Equipment. The Arboretum has acquired 3 fork lifts, 1 portable cement mixer, and numerous other small tools, equipment, and supplies at no cost to the Arboretum through Federal Excess Property.

The following items have been purchased by the Arboretum:

--1 International Skid Loader	$ 5,758.00
--2 Hustler Mdl. 272-A & Mower Attachments	8,684.00
--2 Stull Chain Saws	486.00
--2 1-1/2 ton Stake-body Dump Trucks	16,000.00
--1 Sedan Delivery Station Wagon	4,000.00
--1 Electric Welding Machine	229.00
--1 Hilo-Arc Welding Machine for Aluminum	1,000.00*
--1 Radial Arm Saw and several small shop tools	1,113.00

*Friends of the Arboretum funds

Security

The Arboretum guard force fluctuates between 3 and 5 officers. Currently, there are 3 full-time guards. Beginning in October 1977, funds were provided to permit contracting for outside security guards for the night shift when the Arboretum is closed to the public. This frees the Arboretum force for day-time duty when there are many visitors.

Regretfully, we have had to reduce our public hours by closing at 5:00 p.m. throughout the year. This more or less coincides with the work day and means that there will be no lengthy period during the week when the gardens will not be occupied by employees. We still rely only on two Arboretum guards and the District of Columbia police for road security on week-ends, but this does not allow for security in any gardens except for the Bonsai Pavilion.

Safety

We are constantly seeking ways to protect our employees from health hazards and injury. In this regard, all field employees have been provided with steel-tipped safety shoes. In addition, lectures were held for all employees concerning such matters as appropriate lunch diets, effects of smoking, high blood pressure, and cancer. Free blood pressure checks were provided to all employees.

A number of safety hazards were eliminated by a dedicated committee under leadership of Mr. Gene Eisenbeiss. Many of these were simple improvements in housekeeping, while others entailed expenditures for boiler inspections, replacement of all over-aged fire extinguishers and first aid supplies, establishment of a First Aid Room adjacent to the lobby and accessible at all times.

G. U.S. National Arboretum - Weather, 1977

For more than 30 years, the U.S. National Arboretum, in cooperation with the U.S. Weather Bureau, has maintained daily records of weather conditions. These are summarized monthly for the Weather Bureau, with copies of the reports maintained for use by the Arboretum staff.

A comparison of conditions in 1977 shows that, weatherwise, the past year was an extreme one for the National Arboretum in many respects. Total annual precipitation for the previous 10 years, 1967 through 1976, was 46.97 inches, ranging from a low of 41.55 inches to a high of 56.62 inches; while the total recorded for 1977 was only 38.03 inches. Although, during the 120 months of the previous 10 years, we recorded only 2 months with less than 1 inch of precipitation, in 1977 we experienced 2 months with less than 1 inch (February, 0.63 inch; September, 0.45 inch).

The highest temperature recorded during 1977 was 101° F. (July); as compared with the previous 10 years when the high recorded was 99° F. (July 1969). In January 1977, we recorded a low of -1° F., while for the previous 10 years, the low was 2° F., which occurred in both January 1972 and February 1973. The winter of 1976-77 provided a true test of cold hardiness, with an extremely long period of below freezing temperatures. From the night of November 29, 1976, when the temperature dropped to 16° F. through February 28, 1977, we experienced Hnly 11 nights when the temperature rose above the freezing point.

H. New Cultural Acquisition of Bamboo Wares

The Arboretum was the recipient of the Department's collection of bamboo wares. This is an extensive assemblage of household and other articles crafted in Japan and China previously held at the Barbour Lathrop Garden, Savannah, Georgia. The collection contains some 1,500 items--baskets, trays, implements, vases, and tools crafted from bamboo--gathered by Departmental plant explorers in the Orient. The collection is completely curated, and a display in conjunction with other Japanese horticultural arts is planned for October 1978.

PLANTS, PLANTINGS, AND HORTICULTURE

A. Plant Records, Mapping, Graphics, and Labeling

From January 1977 through December 1977, the following accomplishments are noted:

--A total of 1,675 plants, seeds, scions, and cuttings were accessioned.

--Approximately 1,450 new record and display labels were added to, or replaced, in various plant collections throughout the Arboretum.

--Inventories and plant locations maps were completed for the Magnolia area, the area surrounding the Administration Building, and a large percent of the beds in the Gotelli Collection.

--Sue Hofer, a student at VPI, joined our unit for the summer and illustrated the text for a new set of 100 interpretive signs to be completed this year.

--Sherrill Sasser, a horticultural graduate of VPI, joined the unit as mapper and graphics technician.

--Research and planning of the Arboretum's program for the blind and handicapped was furthered through research and joint meetings with various groups of blind and handicapped persons in the Washington area to discuss their needs and interests relative to horticulture and the Arboretum.

--Roberta Douglas traveled to Boston to discuss plant records systems, graphics, and labeling with members of the staff at The Arnold Arboretum. She also visited several braille trails, and discussed braille trails and programs for the blind at Perkins Institute for the Blind.

--In May 1977, Ms. Douglas gave a talk on the design, philosophy, and construction of the Japanese garden accompanied by a slide show.

--Ms. Douglas designed the exhibit for the Arboretum's exhibit in the Spring Flower Show held in the D. C. Armory and continued to lead the team in planning and planting the garden which was awarded the First Prize in the Educational Category.

B. Plant Collections

Camellia and Garden Club of America Plantings. Due to the extremely cold temperatures (-1° F.), lack of rain, and continuous winds during the winter months, the camellias and the Garden Club of America planting suffered extensive plant losses. Almost the entire *Camellia sasanqua* collection was lost as were many 30-35-year old *Camellia japonica* plants thought to be hardy up until this time. Many plants had to be cut back to the ground. Fortunately, many of the less common *C. sasanqua* sent up enough new growth to take cuttings, so that they will not be lost entirely. Unless those plants that suffered so much damage can be replaced by mature specimens, it will take at least 10 years for the collection to recover to its previous condition. The total extent of damage from the winter of 1977 and

projections for losses due to the winter of 1978 have not yet been realized. It is expected to be severe. We estimate the cost in loss of mature plants and labor necessary to renovate the area to be in excess of $200,000.

Work on the new Overlook and valley is progressing steadily and will be a definite asset to the Arboretum upon completion.

Fern Valley and Daffodil-Ivy Collections. Expansion of the Fern Valley collection of native plants has been based on the creation of new habitat areas. Such situations are necessary for the protection of the plants as well as to represent a realistic natural association of our indigenous flora. Rockeries and protective borders have been constructed to serve this purpose. Other areas have been protected with new shrub plantings. Wildflowers and ferns have been planted and will continue to be planted in these areas.

New additions to Fern Valley include wildflowers and ferns purchased with Friends of the Arboretum funds. Other accessions were donated by Dr. John Baker, a private collector in Minnesota. Mr. Roy Brewer of Virginia donated native shrubs and a collection of violets. The roadside plantings were expanded with new trees and shrubs including several specimens of Alnus maritima, an endangered species. Several threatened and endangered rhododendrons have also been added. Educational display signs have been placed on the Fern Valley Trail.

The meadow planting has been enlarged with the addition of Aster spp., Lythrum spp. (loosestrife), and Asclepias tuberosa (butterfly weed). A foot path has been established in this area for easy access to the various kinds of plants.

Miniature ivies and split corona daffodils (Division 11) have been added to the Daffodil and Ivy Collections. Many of these new accessions have been planted in recently constructed rockeries. Native ferns and wildflowers will be used as companion plants to the daffodils and other bulbs recently naturalized.

A bench donated in honor of Ethel Peters, late NCAFGC member and former guide, was placed in a setting of rhododendrons, mountain laurel and daffodils.

The Youth Conservation Corps did an excellent job of renovation, construction, and planting in Fern Valley and in the Daffodil and Ivy Collections. New bridges and stone walls were constructed, as well as protective borders adjacent to the trails. Lady ferns (Athyrium filix-femina) that the YCC collected were planted behind the protective borders. The YCC was also involved in planting over 80 specimens of rhododendrons and mountain laurel. Honeysuckle and tree seedling removal was another important job the group accomplished. The work that the YCC group did has been highly commended by everyone.

Gotelli Conifer Collection. The documentation of the Gotelli Collection was completed in December 1977. All information, maps, photographs, and herbarium voucher specimens are being placed in final record catalogue in the herbarium. Illustrated labels being placed in the collection now total 104. Fifty-eight accessions, totaling 133 plants have been added to the collection.

Boxwood, Daylily, Peony Collections. After an extensive period without a curator for these collections, we were fortunate in employing Mr. Lynn R. Batdorf in April 1977. Mr. Batdorf is a 1974 graduate of the Institute of Applied Agriculture, University of Maryland. He comes to us with an excellent background in grounds maintenance and daylily culture.

Twenty new and different boxwood cultivars have been added to the collection. The boxwood planting has been remapped. Plants have been checked for proper identification and relabeled as necessary. The weed problem has been brought under control and all beds have been mulched.

Special beds have been made for daylilies selected by the American Hemerocallis Society (AHS) in the following catagories: Stout Medal Winners, Donn Fischer Memorial Cup Winners, tetraploids, and a changing bed of the top 20 daylilies chosen by the AHS in their Popularity Poll.

A collection of 45 award-winning Iris have been added to the area, courtesy of the Chesapeake and Potomac Iris Society.

Mr. Batdorf has made contact and is in good standing with the National Capital Daylily Club, American Boxwood Society, Chesapeake and Potomac Iris Society and the American Peony Society.

Bonsai Collection. The year of 1977 was a year of settling in for the plant material in the Japanese garden and the Bonsai Collection. The severe winter of 1976-77 damaged many of the camellias and Japanese hollies in the garden, and they had to be replaced. A section of the Bonsai shelter was covered and heated to a night temperature of 25-30° F., providing very satisfactory winter protection for the Bonsai. This also provided a place where the Bonsai could be viewed by the public during the winter.

The trip to Japan (March 14 to April 17, 1977) by Mr. Robert F. Drechsler, Curator of the National Bonsai Collection, proved very educational in learning first-hand about bonsai culture and the Japanese way of life. He studied with three of the Bonsai Masters in Omiya, Mr. Takeyama, Mr. Hideo Kato, and Mr. Saburo Kato. These studies were basically on root pruning and repotting of old bonsai. He also studied with Mr. Shibahata and Mr. Kenko Rokkaku, specializing in azalea bonsai. Many bonsai nurseries and Japanese gardens were visited where Mr. Drechsler was able to observe and study the maintenance of Japanese

gardens and bonsai. Travel was supported with funds from the Merrill Foundation.

During the first year, over 100,000 visitors viewed the Japanese garden and Bonsai Collection. A new program-aid has been printed to assist in the publicity of the collection, as well as giving visitors information about it.

Again, in 1977, we had the continued volunteer help of Mrs. Ruth Lamanna. During the time Mr. Drechsler was in Japan, she spent several days a week with the collection and assisted in the repotting of some of the Bonsai.

Azalea-Rhododendron Collection. Since the last report to the Council, Mr. Ronald Waldron, Curator of the Azalea-Rhododendron Collection, resigned creating a vacancy from July to November. Another member of the garden staff has been on extended sick leave since November 1977. The losses in manpower continue to restrict the level of maintenance desirable for this area, although the future seems to be more promising.

In November 1977, Mr. Ronald Bare was promoted to Curator of this collection. Mr. Bare was previously Assistant Curator of the Bonsai where he did an excellent job. He has a B.S. in horticulture from the University of Maryland. Under Mr. Bare's leadership, we are expecting to make the most of our limited manpower. Work was started to eradicate the honeysuckle and grape vines from the azalea hillside. The completion date for this major task is set for the spring of 1978.

Greenhouse, Propagation, and Production. A new electrical system was installed in the propagation and production greenhouses, including new lights for growth promotion. A new mist system was installed in the propagation house, along with a heated tank for starting tropical water lilies. Two plastic greenhouses (27' x 90') were constructed for overwintering container-grown plants. A small nursery plot of 2,400 sq. ft. was cleared behind the plastic house for growing on specimens for the grounds.

In January 1977, Mr. Loring I. Benedict was promoted to Greenhouse Foreman, filling the vacancy created by Mr. Thurman J. Dade's earlier promotion. Mr. Benedict graduated from the University of Maryland in 1972 with a B.S. in Agriculture. His employment at the Arboretum from April 1974 to the time of his promotion was as Research Technician with the Shrub Breeding Project.

C. Plant and Seed Distribution Programs, 1977

Domestic Plant Distribution

Number of participating arboreta, botanic gardens and research institutions	235
Number of institutions requesting plants	154
Number of items available for distribution	32
Number of plants sent	2665

Commercial Plant Distribution

Number of participating nurserymen	40
Number of nurseries requesting material	25
Number of items available for distribution	6
Number of plants sent	843

Formal Overseas Seed Exchange - Index Seminum

Number of arboreta, botanic gardens and research institutions participating	240
Number of institutions requesting seed	139
Number of items available	213
Number of seed packets sent	2957

Special World-Wide Distribution - NA Introduction Cupressocyparis x leylandii 'Silver Dust'

Number of arboreta, botanic gardens and research institutions participating	307
Number of institutions requesting plants	130
Number of plants/cuttings sent - plants	236
- cuttings	139

Special World-Wide Distribution - NA Introduction Eurya japonica 'Winter Wine'

Number of arboreta, botanic gardens and research institutions participating	307
Number of institutions requesting plants	112
Number of plants/cuttings sent - plants	104
- cuttings	212

Special World-Wide Distribution - NA Introduction Taxus x hunnewelliana 'Richard Horsey'

Number of arboreta, botanic gardens and research institutions participating	307
Number of institutions requesting plants	156
Number of plants/cuttings sent - plants	306
- cuttings	36

Special World-Wide Distribution - Rhododendron Species

Number of arboreta, botanic gardens and research institutions participating	75
Number of institutions requesting plants	59
Number of items available	37
Number of plants sent	3801

Special Overseas Plant Distribution - *Ceanothus integerrimus*, *Juglans cinerea*, *Juniperus conferta* 'Emerald Sea'

Number of arboreta, botanic gardens and research institutions participating	72
Number of institutions requesting plants	24
Number of plants sent	84

Special Requests - World-Wide, for plant material from NA Collections

Number of requests for plants	143
Number of plants sent	4113
Number of requests for seed	36
Number of seed packets sent	123
Number of requests for cuttings/scions/divisions	71
Number of cuttings/scions/divisions sent	7328

Selected examples of the above listed requests include: Cuttings of *Cryptomeria japonica* to Dr. David Watt, University of Colorado, Boulder, for use in a research project involving the chemical isolation of a possible antitumor agent; cuttings of 46 *Buxus* species and cultivars to Mr. Tom Ewert, Blandy Experimental Farm, Boyce, Va., for expanding their boxwood collection; pollen of 8 deciduous azalea accessions to Dr. Francis deVos, Landscape Arboretum, Chaska, Minn., for use in breeding program; cuttings of 13 *Camellia japonica* accessions to Mr. Hugh F. Rouk, Oklahoma State University, Stillwater, for cold hardiness testing in Stillwater; scions of 2 *Malus* species to Mr. Antonio Jose Teixeira de Sousa, Centro National de Fruticultura, Alcobaca, Portugal, for use in a study to develop fruit tree root stocks resistant to the fungus *Roselinia necatrix*; seed *Pinus bungeana* to Mr. Norman W. Baer, Horticulture and Forestry Department, South Dakota State University, Brookings, South Dakota, for testing adaptability to shelter belt planting in the northern Great Plains; cut branches of *Pinus strobus* to Mr. Henry Evans, Printmaker, San Francisco, Ca., for botanical illustration; leaves of *Zizyphus jujuba* to Dr. Bruce Halpin Bio-psychology Lab., Cornell University, Ithaca, N.Y., for extracting the compound zizyphin--this compound inhibits the ability to taste sugar and will be used in taste testing experiments; cuttings of 18 American cultivars of *Camellia japonica* and *C. sasanqua* to Mr. Ichiro Sakanashi, Higashiyama Botanical Garden, Nagoya, Japan, for expanding their camellia collection; cuttings/scions of 55 dwarf conifer cultivars to Dr. Robinson J. Hindle, Department of Plant and Soil Science, University of Rhode Island, Kingston, for expanding the dwarf conifer collection at the University of Rhode Island.

Total Number of Plants/Cuttings/Scions/Divisions/Seed Packets Shipped

Plants	15,109
Cuttings/scions/divisions	7,715
Seed Packets	3,080
Total Number of Shipments	1,049

Plant Acquisitions (some significant donations/purchases)

Plants of 3 West Coast *Asarum* species from Dr. Bruce Bartholomew, University of California Botanic Garden, Berkeley, Ca.; plants of *Sycoparrotia* x *semidecidua* from Russerholz Baumschulen, Oberrieden, Switzerland; cuttings of *Crataegus monogyna* var. *praecox* from Washington Cathedral, Wash., D.C.; bulbs of 5 lily cultivars from the Potomac Lily Society, Wash., D.C.; first donation of plant material for the National Herb Garden--30 plants of *Rosa* 'La Reine Victoria' from Mr. and Mrs. Fred Edmonds, Jr., in memory of Dorothy Stemer; plants of 4 native azalea species from Callaway Gardens, Pine Mountain, Ga.; tubers of 2 dwarf *Nelumbo* cultivars from Sam Caldwell, Nashville, Tenn.; plants of 5 *Cornus florida* cultivars for the dogwood collection through the generosity of Mrs. Milton Weir, New York, N.Y.; seed of 24 woody species native to Korea, collected in the wild by Robert de Belder, Arboretum Kalmthout, Belgium; plants of 9 Glenn Dale azalea cultivars from Brookside Gardens, Wheaton, Md.; plants of 7 *Chrysanthemum* cultivars used for bonsai from William N. Valavanis, Rochester, N.Y.; bulbs of 15 *Lycoris* species and cultivars from Sam Caldwell, Nashville, Tenn.; plants of *Aesculus indica* 'Sydney Pearce' from Hillier and Sons, Winchester, England; plants of 17 *Hemerocallis* cultivars from Kenneth Peters, Starmont Daylilies, Gaithersburg, Md.; plants of 49 dwarf conifer cultivars from the Don Smiths, Watnong Nursery, Morris Plains, N.J.; cuttings of 28 azalea cultivars from Mrs. Thomas Wheeldon, Gladsgay Gardens, Richmond, Va.; plants of 45 bearded *Iris* cultivars from the Chesapeake and Potomac Iris Society, Wash., D.C.; plants of 11 *Hemerocallis* cultivars from Steve Weber, Damascus, Md.; plants of 5 *Hemerocallis* species from The Arnold Arboretum, Jamaica Plain, Ms.; bulbs of 14 *Narcissus* cultivars from the Daffodil Mart, North, Va.; cuttings of *Cupressocyparis* x *notabilis* and *C.* x *ovensii* from J. D. Bond, The Great Park, Windsor, Berks England; a plant of *Cedrus atlantica* 'Glauca' presented by the Landscape Critics Council, National Capital Area Federation of Garden Clubs in honor of Mrs. Vernon L. Connor, past President, Federation of State Garden Clubs. The tree was planted at the Arboretum's Activity Center.

Special

The National Arboretum participated in the First Annual Nagoya Flower Show, Nagoya, Japan, by sending cut specimens of 26 American conifer species and cultivars. The show took place the end of April 1977, and was visited by 144,500 people. The show is sponsored by the Chunichi Newspaper, Nagoya Botanical Garden, and the Chunichi Horticultural Society with assistance from Japan Airlines.

EDUCATION, PUBLIC SERVICES AND LIBRARY

A. Education and Information

Response to Public Queries. The Education Office answered 8,700 questions about plant problems, National Arboretum classes, horticultural events and Arboretum collections. Because of the volume of inquiries, many plant information questions are now being referred to the Botanical Gardens, USDA specialists, and the area extension services where they have more adequate staff. Telephone calls accounted for approximately 4,450 inquiries and the remainder were divided between personal contact with Arboretum visitors and written correspondence. Written inquiries accounted for approximately 1,750 requests for information, while walk-in visitors accounted for the greatest increase in requests for information with a total of approximately 2,500.

Volunteer Guide Service. Twenty-six volunteer guides conducted 143 tours of the Arboretum during the past year. The volunteer guides under the supervision of the National Capital Area Federation of Garden Club's Volunteer Guide Chairman, Ms. Judy French, held intensive guide training classes covering a wide range of topics. Plant society specialists and Arboretum staff members participated in the training sessions. A series of classes on herbs taught by Mrs. Dayton Frost was a highlight of the training program.

School groups and garden clubs accounted for nearly one-half of the above tours with the balance consisting of senior citizens, junior garden clubs, county extension tours, diplomatic wives, garden editors, college groups, miscellaneous professional groups, and others.

In addition to the tours handled by the volunteer guide service, 72 tours were conducted by members of the Arboretum staff.

Volunteer guides from Longwood Gardens and Morris Arboretum, as well as Friends from the Pennsylvania Horticulture Society, spent a day at the Arboretum with Judy French and other Arboretum guides in order to acquaint themselves with the National Arboretum and our Volunteer Guide Service.

Botanical Art Displays. The number of art displays has been reduced by changing from monthly exhibits to a 6- to 8-week format, thus saving staff time in scheduling, hanging, packaging, and shipping of the exhibits. The necessity of installing many of the exhibits on weekends for the convenience of the artist continues to be a problem. Fourteen exhibits of a botanical or horticultural nature representing a variety of media and subject matter were exhibited on the lobby walls and in a museum case in the Administration Building during the past year.

The National Arboretum was pleased to exhibit a special collection of paintings of the National Bonsai Collection by Barbara Russell, the well-known Washington watercolorist and, currently, a member of the National Arboretum Advisory Council.

Arboretum Exhibits. Arboretum staff members have provided the following special exhibits for display at various shows or functions:

--Bonsai Exhibit - National Press Club, Washington, D.C.
--Conifer Display and Bonsai Exhibit - Annual Spring Flower Show, co-sponsored by the Takoma Park Horticultural Club and Takoma Park Azalea Committee, Takoma Park Municipal Building, Takoma Park, Md.
--National Arboretum Exhibit - "New World of Urban Gardening." The Arboretum received a special Beautification Award from the Government of the District of Columbia, Department of Environmental Services, Office of Community Beautification.
--The 1977 "New World of Urban Gardening" - Sponsored by the Office of Community Beautification, this event was held at the National Arboretum and attended by many visitors and dignitaries including First Lady Roslyn Carter and Mayor Walter Washington.
--Bonsai Exhibit - Metropolitan Horticulture Show, Tysons Corner Shopping Mall, Tysons Corner, Va. Show co-sponsored by Cooperative Extension Service of VPI and SU, University of Maryland, Washington Technical Institute, the Professional Grounds Management Society and the National Park Service.
--The National Arboretum--Past, Present and Future - Washington International World of Plants, Capital Center, Largo, Md. Awarded a "Certificate of Award."

Popular Publications. Twelve Program Aids (PA) and USDA Home and Garden Bulletins (HG) were written or revised during 1977. As the Home and Garden Bulletins and Program Aids are revised, new cover art is done which gives a much more contemporary feeling to these publications. The new publication on the National Bonsai Collection is now available, and the revised edition of the PA on the National Arboretum, soon to be available, has been lengthened and a series of photographs have been added to make them more attractive and informative. A PA titled, "The Gotelli Dwarf Conifer Collection" was printed in March 1977, and is now available to the public.

The much delayed Agriculture Information Poster in full color featuring the National Arboretum should be available at any time. This publication will supersede the publication on the Arboretum which was produced at the time of the dedication of the Administration Building and is now obsolete. Nineteen correspondence aids were prepared or revised for public distribution. A re-designed National Arboretum press kit folder was printed this year. This folder is filled with Arboretum brochures and distributed to special visiting groups.

Radio-TV, Talks and Workshops. Mr. Erik Neumann, Curator of Education, presented 23 programs for local and national radio and television and presented 53 talks or workshops to groups ranging from garden clubs, visiting arboretum groups, high school and college classes to educational specialists and press groups. Shows taped for USDA's TV program, "A Better Way" and USDA's radio program, "Consumer Time" are broadcast to over 80 television stations and 520 radio stations, nationwide.

Special talks included a presentation on National Arboretum Education Programs given at the regional meeting of the American Association of Botanical Gardens and Arboreta and a presentation to a University of Maryland class on botanical gardens.

Special Projects. Mr. Neumann is involved in several Metropolitan Washington projects including the following:

--The Widening Horizons Classroom and Field Demonstrations - The Arboretum's Education Office again participated in Widening Horizons, a District of Columbia project to acquaint underprivileged youth with government activities and opportunities. Within each participating Federal agency, the program is hosted by wives of cabinet-level officials.

--Future Farmers of America - Serves as member of the Ornamental Horticulture Study Committee of the FFA. The consulting committee is charged with evaluating and revising the Ornamental Horticulture Proficiency Award Program to make the program more challenging and meaningful to more FFA members.

--District of Columbia Experiment Station - Serves as member of the Advisory Board. The Station, established by congressional action, has as its mission the conduct of appropriate problem-solving research related to food and consumer economics, outdoor recreation, and environmental quality. The principal functions of the Advisory Board are (1) provide advice on the nature of problems to be undertaken in relation to need and financial resources; (2) assist in keeping citizens informed of experiment station goals and objectives; (3) support requests for research funds from the District Government, the Congress, and other public and private organizations; and (4) periodic review of the experiment station's program of research and advise alternatives for improvement.

--Serves on Search Committee for the selection of the Dean of Natural Resources, University of District of Columbia.

--Serves on the Advisory Council of the Flower Show jointly sponsored by the D.C. Branch of the Professional Grounds Management Society and the D.C. Armory Board.

--The New World of Urban Gardening - Served as member of Planning Committee. The New World of Urban Gardening held a horticultural fair at the Arboretum in the spring of 1977. The Arboretum participated with an exhibit. The fair was a cooperative venture sponsored by the CURB Beautification Division of the Dept. of Environmental Services of the District of Columbia.

--National Bird Garden Committee - Mr. Neumann serves as a member of this committee along with members of the Audubon Naturalist Society of the Central Atlantic States who have an interest in creating a national bird garden at the Arboretum. This garden is to be designed to demonstrate good principles of landscaping to attract birds and other wildlife. In a real sense, the entire Arboretum is a bird garden. The purpose of dedicating a special area is to provide a focal point for drawing attention to the Arboretum's birdlife and a demonstration of what can be done with plantings, feeders, nesting boxes, and baths to attract birds. The garden will satisfy the basic needs of birds--food, shelter, water, nesting, and roosting sites--in a way that is both esthetically pleasing and ecologically sound. It will be a place where the careful observer can see a variety of birds at any time of the year or gain new ecological insight from serious study, and where the casual visitor can simply enjoy nature and the beauty of the Arboretum in quiet, pleasant surroundings. The bird garden also will be the focus of a new Arboretum-wide systematic investigation by members of the Audubon Naturalist Society of the food and habitat preference of birds. Despite much published information on this subject, there is a great need for additional research. This fits right into the basic aims of the Arboretum and will add a whole new dimension to our current research/education program. It is hoped that a National Bird Garden will become a truly national example and inspire similar gardens all across the country. A 15-acre site in the vicinity of the "M" Street entrance has been designated for this garden. Systematic bird counts were made in February 1977, in order to obtain a measure of bird use of the proposed site prior to its development. Plans for the garden have suffered a temporary setback, since a joint proposal with the Audubon Naturalist Society, the National Audubon Society, and Defenders of Wildlife requesting funds from the George S. Whittell estate was turned down.

We are fortunate, however, in that the National Plant Materials Center of the Soil Conservation Service has expressed an interest in providing stock of plant material suitable for the bird garden once plans are developed.

--USDA Graduate School Committee on Field Studies and Horticulture - Serves on this committee as coordinator of the National Arboretum Horticulture Series. Responsibilities include selection of instructors, course content, and promotion of the program. Regularly attends USDA Graduate School Teach/Learning Effectiveness Workshops held for Graduate School faculty and staff.

This past year, we have had to re-evaluate our course offerings in light of the availability of rooms, insufficient help in

setting up or re-arranging tables and chairs, cleaning of rooms, and the amount of publicity necessary to attract the numbers of students required to economically hold these classes. Those courses which are the most popular have been retained, while those requiring substantial publicity through the local media have been dropped. The content of some classes has been changed by lengthening the course and incorporating material from other classes which had been dropped. Two classes were combined into one with a redesigned curriculum. Nine classes have been eliminated.

The following classes are now held on a regular basis at the Arboretum in the National Arboretum Horticulture Series and in the National History Field Studies Program in cooperation with the Audubon Naturalist Society:

--Basic Methods of Plant Propagation
--Indoor Light Gardening
--Plants in the Home
--Botany for Gardeners, Nature Lovers, and Photographers
--Introduction to Bonsai
--Introduction to Indoor Bonsai
--Herbs
--Vegetable Gardening
--Christmas Decorating with Plant Materials
--The Home Greenhouse
--Annuals, Perennials, Bulbs, and Roses
--Ornamental Woody Landscape Plants I, II, III
--The Care and Maintenance of Outdoor Plants
--Nature Photography Workshop
--Woody Plant Identification
--Spring-Flowering Identification
--Non-Flowering Plants
--Ferns and Fern Allies

The Adult Education classes are taught in a 3- to 10-session format, making use of classroom and greenhouse facilities at the Arboretum. Instructors include Arboretum staff members as well as specialists from local plant societies and the Extension Service.

Meetings and Events. Regularly scheduled horticultural and botanical organization meetings held in the Arboretum auditorium: The Botanical Society of Washington, National Capital Orchid Society, Indoor Light Gardening Society, Gloxinia and Gesneriad Society, Washington Bonsai Club, and Orchid Judging Center meet on a monthly basis; Camellia Society of the Potomac Valley, Potomac Valley Chapter of the American Rhododendron Society, and Brookside Bonsai Club meet bimonthly; Washington Daffodil Society, Washington Daylily Club, and Potomac Lily Society meet quarterly; and the Potomac Valley Chapter of the American Rock Garden Society meet annually. The National Capital

Area Federation of Garden Clubs, Inc., hold bi-monthly meetings at the Arboretum, as well as various committee meetings throughout the year including a flower show school and landscape critics council.

Other special meetings and events held at the Arboretum: The District of Columbia Cooperative Extension Service's CORE training in fulfillment of EPA regulations, as well as other specialized workshops and examinations; the National Association of Farm Broadcasters wives had a tour and luncheon with special guests, Mrs. Bob Bergland and wives of other Department officials; Board of Directors of the American Association of Botanic Gardens and Arboreta--plans for the annual meeting of AABGA to be held in May at Hamilton, Ontario, Canada, were formulated; Boxwood Workshop sponsored by the Cooperative Extension Service, Extension Division, VPI and State University, Department of Horticulture in cooperation with the American Boxwood Society; Soil Conservation Service, Northeast Agronomy Workshop; and the unveiling of the 1977 Yearbook of Agriculture, "Gardening for Food and Fun", attended by the Secretary of Agriculture Bob Bergland, Yearbook authors, members of the Press, and USDA staff members.

Flower Shows. The following plant societies held flower shows in the auditorium of the Administration Building: Indoor Light Gardening Society, Potomac Valley Camellia Society (fall show), Washington Daffodil Society, Potomac Bonsai Association, National Capital Daylily Club, National Capital Iris Club, and the National Capital Orchid Society. These flower shows play an important role in the Arboretum's educational program, and their attendance is overwhelming.

Tours, Horticultural Demonstrations, Films and Nature Walks - In order to keep the public informed of events at the Arboretum, the Education Office issues an events newsletter listing nature walks, tours, horticultural and botanical films, special exhibits, horticultural demonstrations, and lectures held at the Arboretum. A separate listing of flower shows and art exhibits is now mailed to over 6,800 individuals who have requested notice of National Arboretum activities. These publications have been sent on a regular basis to the Washington Convention and Visitors Bureau, local newspapers, and radio and television stations for listing and for publicity purposes.

The events for the public regularly scheduled at the Arboretum during the winter months have been eliminated, thus relieving us of the burden of one mailing. In addition, another mailing was saved by sending the list of flower shows and art exhibits along with the spring mailing rather than at the first of the year. Lack of help for folding and stuffing envelopes necessitated the re-examination of priorities with a resulting reduction in programs for the public during this slack time of the year.

Forty-two specialized tours, horticultural demonstrations, films, and nature walks were held during 1977 for the general public.

Seventeen press releases were written and sent to the local media concerning publicity for Arboretum classes, flower shows, nature walks, special programs, and other events of interest to the public.

Special Items

--A concentrated effort continues to be made to photograph plant material commonly used in the landscape in order to assemble a comprehensive set of 35mm slides to be copied and made available for teaching purposes through the Education Committee of the American Society for Horticultural Science.

--Four programs pertaining to employee health were presented in the Administration Building auditorium for all employees. The American Cancer Society presented a program on colon and rectal cancer and on smoking, the American Heart Association on hypertension, and the USDA Food and Nutrition Service on proper nutrition emphasizing foods which may be included in a bag-lunch.

--Participated in Public Information and Publications Workshop given by the Smithsonian Institution's Office of Museum Programs, Washington, D.C. Individual sessions dealt with long-range and short range activities, fund raising, relations with other organizations, the news media, publications (including newsletters, brochures, and special publications), and the overall role of public relations within an institution.

--Presented programs on the activities of the Arboretum to participants in Youth Conservation Corps programs from Andrews Air Force Base, Beltsville Agricultural Research Center, and the National Arboretum.

--Participated in National Career Guidance Week held at Cordoza High School in Washington, D.C., with a program on careers in horticulture and related fields.

--Gave a short presentation on future developments of the planned educational facilities on the newly acquired "brickyard" property at a Problem Solving Symposium, "Facing the Future", held by the American Association of Botanical Gardens and Arboreta at Callaway Gardens, Pine Mountain, Ga.

--Mr. Neumann participated in the program for the Wood Products Training Course sponsored by the Defense Logistics Agency, Defense Construction Supply Center, Columbus, Ohio.

--Served as advisor for the National Capital Area Federation of Garden Clubs, Inc., Horticulture School for Growers, Exhibitors, and Judges.

--In cooperation with the National Capital Area Federation of Garden Clubs and Symmes Systems, Atlanta, Ga., the NCAFGC now has copies of National Bonsai Collection Guidebooks on sale in the Federation's Gift Shop at the Arboretum.

--Under a cooperative agreement with the NCAFGC, volunteer aids are provided to staff the Information and Activity Center. Some daily instruction and orientation concerning collections, programs, and special events at the Arboretum is offered to the volunteers by Ms. Mary Ann Jarvis, Education Office Assistant.

--Participated in the Annual Eastern Garden Writers Symposium, "Cultivating the Word: Gardening Communication Today", held in Philadelphia, Pa. The two-day symposium was designed to help the participant communicate about a subject whether it is a report to a club, a book for a publisher, an after dinner speech, or getting out a magazine or newsletter. The conference focused on getting an idea, packaging and promoting it, and how to conceive and publish a magazine from a manager's, editor's, and designer's point of view. On the second day, modes of communication other than writing, including films, television, and multi-media shows, were explored.

B. Library

Members of the Library Committee for 1977 were Erik A. Neumann, Chairman, Frederick G. Meyer, William L. Ackerman, Gene K. Eisenbeiss, and Judith L. Shirley, representing the Arboretum, with John L. Creech and Jayne T. MacLean ex-officio. National Agricultural Library (NAL) delegate was Deputy Director Wallace C. Olsen, with Leila Moran, Chief of Reference, as alternate. The service of all these knowledgeable people was especially valuable in guiding policy decisions and in the selection of new books for the collection.

Special Project. This was a year of change for the library, during which the long-planned and prepared-for re-cataloging of the book collection took place. It was a complex operation, despite the fact that no more than 2,000 books were involved. There was some disruption of normal services, though we tried to keep this to a minimum.

Here is a brief before-and-after picture. The library had had a major impediment to convenient self-help use: namely, its setup in two parallel book collections, shelved in separate sections of the reading room, and numbered according to different classification schemes. NAL, its parent library, also has dually classified book collections, but with closed stacks, the situation can be tolerated. However, in a small browsing library it meant that, when scanning the shelves for a certain subject or title, the reader had to check both sections; thus his hunting time was doubled. In addition, both the author/title and the subject card catalogs for the older of the two sections were very incomplete, so that in a catalog search many books could not be found.

As a result of the re-cataloging project, both parts of the book collection have been integrated into a single whole, classified and shelved according to the Library of Congress system. This brings all books on each subject together on the shelves and presents a rational order of subjects for easy browsing. Each book can now be located in the card catalog by looking under the author or title or several appropriate subjects.

The project which accomplished these improvements was funded jointly by the National Arboretum and the NAL (as is the Arboretum

Library itself). To assist the Librarian in the many operations involved, a library technician was hired on a one-year appointment. We were fortunate to find an unusually capable young woman to fill this slot. Modern technology made the project economically feasible and relatively speedy. A computer terminal, with access to a computer which stores cataloging data for the holdings of hundreds of libraries in the United States, was our chief tool in the re-cataloging process. Without this system, original cataloging would have had to be done for each book and cards typed. With it, we were able to find for most of our books, records showing the cataloging that had already been done by another library, and were able to order via the computer printed catalog cards. Complications included having to modify records for many titles and not finding data for about 10 - 15 percent of the books.

An abundance of hand labor went into the project, too, such as scraping off old spine labels and typing and affixing new ones, filing thousands of catalog cards (an average of 5 for each book), and physically changing the location of every book in the library. For these operations, other offices here at the Arboretum were kind enough to lend us some extra hands. There was much cerebral effort as well, especially in mastering the complex conventions of the computer system and of the classification scheme.

A few loose ends remain to be tied up, in particular, original cataloging of some titles, which NAL has agreed to help us complete. Our regular users, who were familiar with the "before" configuration of the library, have greeted the results of the reorganization with enthusiasm--even though all of us will need time to learn our way around again.

Collection Growth - Purchases. During 1977, a total of 112 new books were received via our acquisition budget provided by NAL. These titles were carefully selected by the Library Committee as being supportive of the work of the National Arboretum, and were then ordered through NAL, where they were subsequently received, cataloged, labeled, and forwarded to us. Some representative titles include: American Gardens in the 18th Century, Gibberellins and Plant Growth, Germination of Seeds, Newcomb's Wildflower Guide, Trees and Bushes of Europe, Ornamental Grasses, Flora of Eastern Himalaya, and British Botanical and Horticultural Literature before 1800. There were also various taxonomic works, including several more volumes toward completion of our set of Das Pfanzenreich.

Collection Growth - Gifts. We wish to add our applause for all the speakers on plant and garden subjects whose efforts result in support to the library for the purchase of books, thus serving to educate the public twice. Some of these speakers are members of the professional staff of the Arboretum. Another speaker who has been our benefactor is Mrs. Judson French, Chairman of the Volunteer Guide Service. For the past 7 years, Mrs. French has been turning over her lecture fees to the Friends of the Arboretum for the purchase of rare and out-of-print books

which we are unable to buy through our normal purchasing channels. Our gift book list of 110 in 1977 includes both those donated and those we have been able to buy. Some of the latter titles are Sprengle, Antiquitatum Botanicarum, 1798, Weber, Primitae Florae Holsaticae (facsimile of 1780 ed.), and Rohde, Culinary and Salad Herbs, 1940. Friends of Neal Thompson established a memorial fund which has allowed us to purchase 12 books. Other donated books included VanDersal, Why Does Your Garden Grow?, Yoshimura, Commemorative Album, Muriel Leeds Collection (Bonsai), and Martin, Concise British Flora in Colour.

Automated Information Retrieval. A computer terminal has been widening our library's horizon since February 1977. It saw concentrated use during the re-cataloging project, accessing the Ohio College Library Center computer database of shared cataloging data. In addition, it was available as a literature-searching tool, with access, through NAL, to the Lockheed Systems family of databases containing bibliographic citations and abstracts covering many subject fields; included is NAL's own database, AGRICOLA. In this system one searches by subject or key word or by author's name in order to retrieve citations of papers, articles, or books. Such a search is often the first step to a comprehensive literature survey, or it can stand alone when only recent references are needed, as the database goes back only to 1970. The revolution in bibliographic searching methods introduced by automated retrieval services has required adjustments in thinking and changes in searching habits among scientists and other users of the system. It requires time and experience to learn just what the systems can provide and what they are not able to do. Librarians who are to perform the searches also require considerable training and experience. In May 1977, Mrs. MacLean attended a week-long training seminar sponsored by NAL. In July, two half-day demonstration sessions given by NAL's head of Automated Services were held at the Arboretum and were well attended by the staff. Computer searches had been available at NAL for the past several years, and a few of our staff members had taken advantage of them, but this introduction greatly expanded interest in the possibilities offered. From July to December, Mrs. MacLean ran 37 searches here at the Arboretum Library, about all that could be fitted in between more pressing cataloging operations on the computer terminal. It is expected that demand for this type of service will continue to increase.

Serials and Nursery Catalogs. Not included in the NAL's book budget for the National Arboretum Library are periodicals and other serial publications; these are paid from Arboretum funds and, for 1977, the costs came to about $1,800. We receive close to 200 subscriptions, about evenly divided between paid and gift and exchange titles. The "Contents of Current Periodicals" issued weekly by the library helps to alert our users to useful articles in recently received serials. Those who make a practice of checking this notice each week find much in the current literature that might have escaped their notice otherwise. The updating of the nursery catalog collection, begun last year, made only slow progress due to our efforts being focused on the recataloging project.

Services. At the behest of the National Agricultural Library, statistics of use of our services are kept; these indicate that in 1977, 2,000 readers came in, mainly Arboretum staff, but 350 of them visitors. These numbers are somewhat lower than last year because the library was closed for almost a month while the final book processing and reshuffling took place. About 360 volumes were loaned, for the most part to Arboretum employees. The number of volumes used, self-service, by readers totaled 3,200. Reference questions, including those received by telephone or letter, added up to about 575 from Arboretum people and 275 from others. During the period of greatest disruption in the library, the regular users showed great forebearance and patience, moderating their requests and cooperating in every way. We hope that the increased efficiency with which they can now be served will compensate for these inconveniences.

Mrs. MacLean's bibliographic efforts this year were necessarily limited to one computer-produced bibliography on Herb Gardening and a one-page condensation and update of the bonsai bibliography called "Agri-Topics: Bonsai", which is being distributed free by both the National Arboretum and the National Agricultural Library. In 1978, as soon as time permits, an extensive bibliography covering all aspects of herbs will be compiled to mark the opening of the National Herb Garden.

ARBORETUM RESEARCH

A. Nomenclature and Taxonomy of Cultivated Plants

A survey was initiated several years ago as a long-range project on the documentation and identification of trees, shrubs, and woody vines cultivated in 13, or parts of 13 southeastern states, from Maryland to northern Florida, west to eastern Texas, Arkansas and Tennessee. The aim, ultimately, is for the production of a reference publication for nurserymen, students, and others on the identification of the cultivated woody plants of the southeastern states. To accomplish this, it is necessary to collect material in many different sites over the entire area, i.e. in nurseries, gardens, parks, campuses, cemeteries, experiment stations, arboretums, and botanic gardens. To date, over 5,000 collections have been made in every southern state except Arkansas.

Critical study of the collections takes place in the herbarium after the material is processed by comparison with other specimens and with the pertinent reference literature.

Field work is planned to coincide with the flowering and/or fruiting period of the plants. Usually, we like to collect material in flower and again in fruit at some other part of the year. In 1977, an additional 625 field collections were obtained from about 15 sites in Maryland, Virginia, the District of Columbia, North Carolina, South Carolina, and Georgia. A few of the collecting sites visited are of more than passing interest.

--*South Carolina* - Magnolia Gardens on the Ashley River, near Charleston. The azaleas at Magnolia Gardens are important because the earliest introductions of Indian azaleas from Belgium and England into this country were introduced to Magnolia Gardens by the Rev. John Drayton, beginning in the 1840's. Authentic material of 25 cultivated varieties of Southern Indian azaleas were documented on a trip during the peak of flowering in early April. The cultivar 'Formosa', for example, is probably the most widely planted of the Southern Indian azaleas grown in the South. Originally, 'Formosa' was introduced to Magnolia Gardens by the Rev. John Drayton in the 1840's. Other cultivars, such as 'Duc de Rohan', 'President Claeys', 'Magnolia Alba', and 'Iveryana' have been at Magnolia Gardens for more than 100 years. *Rhododendron* × *phoeniceum*, an old garden hybrid azalea found at Magnolia Gardens, is no longer an easy plant to locate. *Phoeniceum*, with scarlet flowers, is known only in gardens and was introduced to England in 1824 from China. It was one of the early introductions at Magnolia Gardens. Mr. Norwood Hastie, a descendent of the Rev. John Drayton, knows the Magnolia Gardens azaleas extremely well and is able to identify the varietal names with no difficulty, although the collection is not labeled.

Middleton Place on the Ashley River, near Charleston. Known as the oldest landscaped garden in America, Middleton Place gardens were established ca. 1730. Old specimen trees and extensive plantings of camellias dot the property, many of which have been collected on previous visits. The Middleton oak, Quercus virginiana, with a girth of 32.5 feet, is one of the largest recorded specimens in the South. For the first time, material was documented of the double-flowered Japanese wisteria, Wisteria floribunda 'Violacea Plena', a fine specimen growing over a loblolly pine tree near the old rice field.

Charleston. The historic part of the city is a rich source of garden plants - camellias, box, magnolias, cherokee rose, jessamine, and other plants that are associated with gardens of the southeastern coastal plain. A number of gardens in the old quarter have been previously visited and many plants have been previously documented. Several new sites were visited in April 1977, including an old property on Society Street which yielded the following collections of interest: Michelia figo, the banana shrub, a specimen nearly 20 feet tall; Buxus microphylla var. japonica, the Japanese box and Buxus harlandii, plants far more successfully grown in coastal plain areas than the dwarf box, Mahonia fortunei and Photinia glabra. A garden on Church Street, of a more modern vintage, produced a dozen cultivars of Acer palmatum, the Japanese maple, a plant not commonly seen in coastal plain gardens of the South.

--Georgia - Barnsley Gardens, Adairsville. Although the garden has been long neglected, several large specimen trees on the property were documented, including a fine specimen of Cunninghamia lanceolata, the China fir, 70 ft. tall; a specimen of Irish yew, Taxus baccata 'Stricta', 20 ft. tall; a large plum yew, Cephalotaxus harringtonia, with a spread of ca. 20 ft.; and several large weeping box, Buxus sempervirens. A maze of dwarf box, B. sempervirens 'Suffruticosa' is a decorative feature of the garden. In this part of the South, the dwarf box prospers and is much planted on this account. Large specimens up to 8 ft. tall may be found in some gardens of the area.

Rome. Garden of C. A. Hight. Of particular interest were large specimens of Deutzia scabra 'Candidissima', about 8 ft. tall; bur oak, Quercus macrocarpa, which is rarely planted in the South; Japanese evergreen oak, Quercus glauca, ca. 20 ft. tall; and an unusual unnamed form of Ginkgo biloba with branches strongly ascending and forming a broad globe-shaped specimen. Propagating material has been obtained for purposes of establishing this form at the National Arboretum.

--Washington, D.C. - U.S. Capitol Grounds. During the summer of 1977, an attempt was made to document all of the trees and shrubs on the Capitol grounds. In all, 331 collections were made, which represents somewhat more than the number of species and horticultural varieties that are actually represented on the grounds. The collection is

varied and interesting. The oldest and largest specimens are English elms, Ulmus procera, planted in the early years of the 19th century. The largest elm is now just over 5 ft. in diameter. The collection of trees and shrubs on the Capitol grounds is exceeded in Washington, D.C., only by the National Arboretum. It would be useful to publish an inventory of the trees on the Capitol grounds. The first inventory of the trees on the Capitol grounds entitled "Trees of Washington, D.C." by George B. Sudworth and B. E. Fernow, was published in 1891.

Fuchs Herbal Project. (F. G. Meyer in collaboration with Dr. Emily Trueblood, Potomac Unit of the Herb Society of America). The great herbals of the 16th and 17th centuries are written in Latin and, for this reason, have been generally unavailable to most persons. The 16th century herbal "De Historia Stirpium" by Leonhart Fuchs, was published in Basel, Switzerland in 1542. This herbal is acclaimed as one of the most significant landmarks of the pre-Linnean medico-botanical literature. The plan is to publish a facsimile of the original 1542 Latin edition of Fuchs. A second volume is also being prepared with information on the (1) identification of all 511 plant illustrations with their modern scientific names, (2) vernacular names of all 511 plants in eight languages, (3) ancient and modern uses of all 511 plants figured, (4) life of Fuchs, and (5) writings of Fuchs. The value of the herbal lies in the illustrations which were made from life, thus providing one of the earliest references on the identification of plants used for medicinal purposes in the 16th century. Botanically, the book is also significant. At least four New World plants, the pumpkin, bean, French marigold, and maize were illustrated for the first time in the Fuchs herbal. Fuchs coined names for 15 plants native of Germany. The Latin name, Digitalis purpurea, for the foxglove, was first used by Fuchs and is still the valid scientific name for this plant. As co-author, Dr. Meyer is providing identifications on all 511 illustrations, as well as text material related to these plants. The project ties in closely with the objectives of the National Herb Garden to be located at the National Arboretum.

Ancient Plants at Pompeii, Herculaneum and Neighboring Villa Gardens. (F. G. Meyer in collaboration with Dr. Wilhelmina F. Jashemski, University of Maryland). The ancient sites of Campania buried by Vesuvius in the famous eruption of A.D. 79 are unique and of great importance as a first-hand source of information on the plants used in ancient times in Italy. Plants illustrated in wall paintings, mosaics, sculpture, and the carbonized materials are of particular historical interest because most, if not all, of the plants found in these ancient times are still in use today in Europe and in the United States. To date, nearly 100 species - flowers, nuts, grains, and other food plants - have been identified. A forthcoming inventory of the carbonized materials with measurements, descriptions and photographs will be published as evidence of the wide diversity of agricultural crop plants in southern Italy at the beginning of the Christian era.

Prunus (flowering cherries) (R. M. Jefferson). A world-wide source list of ornamental cherry taxa, now in preparation, will be based on a wide literature search of botanical, horticultural, and popular references to verify publication dates, origin, and the nomenclatural accuracy of over 250 named flowering cherries recorded in the literature.

Publication of "The Japanese Flowering Cherry Trees of Washington, D.C." by Roland M. Jefferson and Alan M. Fusonie came out just before Christmas. This handy reference booklet, copiously illustrated (a few in color), represents the first publication of its kind on one of the most universally known horticultural attractions in Washington, D.C. - the cherry blossoms around the Tidal Basin. Over 10,000 copies of the booklet (National Arboretum Contribution No. 4) have been distributed throughout the United States and to many parts of the world. Since the publication became available in January of 1978, 50 letters of praise from the horticultural community and the general public have been received.

Plants propagated from the Yoshino cherry trees planted by First Lady Mrs. Helen Taft and Viscountess Iwa Chinda on the Tidal Basin in 1912 are now established at the National Arboretum and at the Glenn Dale Plant Introduction Station. During the next few years, material from these trees will be propagated and distributed to other cherry plantings in and around Washington, D.C.

Malus (flowering crabapples) (R. M. Jefferson). Authenticated material of 25 crabapple (*Malus*) taxa from the den Boer Arboretum, Des Moines, Iowa, have been established at the U.S. Plant Introduction Station, Glenn Dale, Md. Research and plant accession records at the Morton Arboretum and Pennsylvania State University were appraised and recorded as part of a continuing effort to collect information for an updated reference work on flowering crabapple taxa. Germplasm of *Malus halleana* and *Malus* (R.M.J. 102), two very ornamental and highly disease resistant crabapple selections, have been propagated for distribution to National Arboretum plant evaluation cooperators. The seedling selection *M.* (R.M.J. 102) has been free of virus disease, scab, cedar-apple rust, and powdery mildew for 10 years.

Ilex (holly) project (T. R. Dudley and G. K. Eisenbeiss). Part II of the International Checklist of Cultivated *Ilex* will legitimize epithet priorities and nomenclature of nearly 300 cultivars of *Ilex crenata*, now one of the most important commercial hollies in this country. Information is being compiled for future checklists on cultivars of *I. aquifolium* , *I. cornuta*, *I. vomitoria*, and *I.* x *meservae*. A study of the nomenclatural and taxonomic confusion between *I. crenata* forms *convexa* 'Convexa', 'Bullata' and 'Buxifolia' has been initiated. The taxonomic and nomenclatural confusion between *I. ciliospinosa* and *I. centrochinensis* has been investigated, and the results will be summarized and published. A new holly cultivar, *I. crenata* 'Nakada' was described and published. A nomenclatural and taxonomic investigation of *I. crenata* 'Mariesii' and 'Nummularia' also has been published.

Viburnum project (T. R. Dudley). A number of new Viburnum taxa from Asia have been described as new to science. Descriptions of 12 new species from the People's Republic of China, Vietnam, Burma, and Cambodia are brought together in one paper. Eight original drawings, rendered by the Arboretum artist, will illustrate six of the new species. In a second paper, a number of new intraspecific taxa of Viburnum from various countries in Asia and Turkey will be published.

Dwarf and Slow-Growing Conifers Project (R. F. Doren and T. R. Dudley). Documentation of the Gotelli collection of dwarf and slow-growing conifers continues on a long-range basis for purposes of updating the identifications of the plants. Herbarium specimens and photographs have been prepared for many specimen plants, and these will be deposited in the Arboretum herbarium as a permanent record of the collection.

Flora of Staten Island, Argentina (T. R. Dudley). The first enumeration and analysis of the flora of this sub-antarctic island at the southern tip of South America has been submitted for publication. The paper contains a list of plant collections, as well as ecologic, phytogeographic, taxonomic, bibliographic, and locality data gathered on a joint United States-Argentina expedition in 1971. Listed in the report are 170 taxa (species, varieties, and forms) collected on the expedition. The total number of flowering plants and ferns is small, because of the far south latitude of the island. A shorter version of the paper will be submitted for publication in a botanical journal in Argentina.

Other Herbarium Research. Dr. Dudley has shown that the correct citation of the saucer magnolia should be Magnolia x soulangeana Paris Linn. ex Soulange Bodin. The authority, Chevalier E. Soulange Bodin, in whose garden this magnolia originated, is variously cited in botanical and horticultural literature as Soul., Soul.-Bod., Soulange-Bodin. A description of M. x soulangeana (originally spelled soulangiana) was published by Soulange Bodin in 1826. An English translation of a French publication of 1827 establishes that Soulange Bodin (without a hyphen) did not erect the name soulangeana in his own honor.

A new genus, Zoellnera, of the Amaryllidaceae, with two species, has been named by Dr. Dudley in honor of Otto Zollner of Quilpue, Chile. This new genus is well distinguished from its closest ally Leucocoryne by several technical characters. Mr. Zollner has been sending herbarium specimens of Chilean plants to the National Arboretum for several years.

Dr. Dudley has described a new species, Alyssum pintodasilvae, from Portugal. This plant is of interest because of its ability to accumulate large quantities of nickel. A large group of Alyssum species in one section of the genus are known for their ability to assimilate nickel in large quantities from ultrabasic-serpentine rocks. Dr. Dudley is an authority on Old World species of Alyssum, and is co-author of a

a paper "Hyperaccumulation of Nickel by Alyssum Linnaeus" for publication in the Proceedings of the Royal Society (London).

A genus, Sinoradlkofera, a tree native of southern People's Republic of China, was published as new to science by Dr. Meyer. A plant originally described as Koelreuteria minor over 80 years ago, was found to differ from Koelreuteria in a number of significant characters, especially the white flowers and caruncLulate seeds. The new genus, Sinoradlkofera, turned up routinely in the course of a monographic study of Koelreuteria (mentioned earlier in these reports).

Dr. Meyer contributed the family Valerianaceae, including the genera Valeriana and Astrephia, for the "Flora of Panama", a publication of the Missouri Botanical Garden, St. Louis, Missouri.

Herbarium (P. M. Mazzeo and J. R. McClammer, Curators). Major accomplishments for 1977 include the sorting and filing of over 10,000 herbarium specimens into the permanent collection, bringing the total content of the herbarium to 412,892 specimens. The acquisition of herbarium material is primarily through purchase, exchange and gifts. In 1977, the herbarium received over 10,500 specimens from various sources, i.e. universitities, botanical gardens, and arboretums in this country and from foreign institutions, including Argentina, Australia, Denmark, Chile, Israel, Japan, Netherlands, Rhodesia, Sweden, South Africa, and the USSR. A considerable backlog of specimens has accumulated because of a chronic shortage of plant mounters.

About 200 used herbarium cases have been acquired gratis from the Smithsonian Institution in the past year or so. This extremely valuable acquisition allowed us to fill all of the available space in the herbarium wing with the additional cases for expansion of the collection over the next 5 to 8 years. Because of the additional herbarium cases, a large amount of reorganization was possible in the herbarium during the past year. Mr. McClammer, who joined the herbarium staff in January 1977, has had an active role in accomplishing these moves, especially the shifting and expansion of the entire herbarium into the additional new herbarium cabinets. Mr. McClammer is also responsible for collecting herbarium specimens to document the living collections at the Arboretum. This is an extremely useful function of the herbarium, not only for purposes of documentation, but for research and identification of the living collections at the Arboretum. This backup material provides a means for more accurate labeling of the living plant collections at the Arboretum.

The herbarium was visited by about 70 scientists during 1977 and by eight special tours for college botany and horticultural classes.

Statistical Report

	1976*	1977
Herbarium Material Received		
Number of accessions of herbarium specimens received from institutions and individuals	90	65
Number of specimens received:		
as EXCHANGE	2,721	3,081
as PURCHASE	1,290	1,309
as GIFT (including Staff Coll.)	4,580	6,145
Total Number Specimens Received	8,591	10,535
Herbarium Material Sent		
Number of specimens sent:		
as EXCHANGE	704	609
as GIFT (including specimens for ID)	88	536
Total Number of Specimens Sent	792	1,145
Total Number of Herbarium Cases	700 (permanent collection and storage)	
Herbarium Material Borrowed (Loans)		
Number of loans sent to other institutions	37	21
Number of specimens loaned	2,322	2,754
Number of loans from other institutions	12	7
Number of specimens borrowed from other institutions	295	459
Content of Herbarium		
Number of specimens mounted and added to permanent collection:		
Regular Material	6,486	10,193
Martindale Material	7,188	0
Total	13,674	10,193
Number of herbarium specimens in permanent collection	402,699	412,892
Number of specimens added to Type collection	131	39
Total number of specimens housed in Type collection including clonotypes	1,613	1,652
Miscellaneous identifications sent in by mail (all sources)	459	485
Number of visitors in Herbarium	47	72

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*1 July 1975-31 Dec. 1976 (18 mos.); 1977 (12 mos.)

B. Cytogenetics, Breeding, and Evaluation of Landscape Trees

Betula

Japanese White Birch Seed Orchard Established. Fifteen of the best trees, selected for rapid juvenile growth rate, early bark whitening, and adaptability to poor sites, were dug from the test plots and re-established in an isolated area to serve as a "seed orchard" for superior trees of this species. This orchard includes trees from all five geographic origins and should provide seedlings with a broad genetic background but fairly uniform economic and cultural characteristics. After further progeny testing, this orchard may form the basis for a seed-propagated cultivar of Japanese white birch.

Monarch Birch Under Investigation. Interest in the monarch birch (*B. maximowicziana*) is increasing in the nursery trade. We have pointed out the lack of knowledge and the abundance of misinformation concerning this species (Santamour & Meyer, 1977 -- see "Publications"). Still, it is precisely this lack of factual data that has promoted the current surge of interest. We requested seed of monarch birch from every arboretum and botanic garden (worldwide) that offered the species on their "Seed Lists". With few exceptions, the seedlings we grew were *not* monarch birch. To the few *bona fide* collections, we added material collected from native stands in Japan, and now have several hundred plants, from various sources, under test at "Shady Acres". It is possible that we can establish a "seed orchard" with superior trees of this species also.

Biochemistry. Our survey of bark phenolics by TLC (thin-layer chromatography) has been completed and a manuscript submitted for publication. Acid-hydrolyzed bark extracts of all species except *B. lenta* and *B. nigra* contained rhododendrol, a substance also found in the leaves of several *Rhododendron* species. The presence of another phenolic compound in *B. papyrifera*, but not yet identified, has been useful in determining the hybridity of natural and artificial hybrids involving paper birch.

Hybridization. Work in 1977 was largely confined to crossing with *B. luminifera*, a Chinese species supposedly related to the monarch birch. More than 10 interspecific combinations were attempted, but none produced viable seed.

Plantation Survey. In an effort to determine the landscape potential of various birch hybrids developed in forestry research programs, we surveyed several 20- to 35-year-old plantings established in the Northeast by the U.S. Forest Service. The survival and growth of paper birch was far superior to hybrids of paper x gray and paper x yellow. In fact, all trees of paper x yellow birch parentage, that looked so good several years ago, have died.

Gleditsia

There was a time when the "honey" of the honeylocust (the high-sugar containing pulp of the pod) was a major factor in the increased cultivation of this species. The pods proved to be a highly nutritious supplemental food for cattle. In response to numerous inquiries from foreign countries (notably India and the Republic of South Africa), we entered into a search for information and plants of the selected cultivars 'Calhoun' and 'Millwood', and others. We have been mildly successful but recently have issued a call for help to the arboretum fraternity in locating additional plants. The National Arboretum can serve as a clearing-house for the distribution of propagating material of "sweet" honeylocusts. Our ultimate aim is to establish a seed orchard for the continuous production and worldwide distribution of superior seed.

Ilex

Both *Ilex chinensis* and *I. pedunculosa* have many desirable horticultural attributes, but have been largely neglected in past breeding research. Over the past few years, we have attempted a large number of hybridizations on these species to thoroughly test their crossability potential. Crosses of *I. chinensis* with species of Section Aquifolium and with various deciduous hollies did not produce seed. *Ilex chinensis* did, as before, produce hybrids with *I. sugeroki*, *I. glabra* and F_1 hybrids involving those species. A new hybrid produced was *I. chinensis* x *I. liukiuensis* (*I. liukiuensis* was introduced into cultivation by Dr. Creech). The successful crosses with *I. chinensis* thus involved only species in Section Lioprinus but with the exception of *I. opaca* and *I. crenata*.

I. pedunculosa also belongs to Section Lioprinus, but did not cross with *I. chinensis*. Several hundred intra- and inter-sectional combinations with *I. pedunculosa* were attempted, but no verified hybrids were produced.

A number of cultivars that had passed through the Evaluation phase are being readied for Stock Increase, and four cultivars that had been Stock Increased will be released in 1978.

Liquidambar

The winter of 1976-77 at our Beltsville test area proved to be a strong selection agent among our hybrids between our native sweetgum and the rather tender Turkish and Formosan species. A single selection of *L. styraciflua* x *L. formosana* proved to be cold-hardy and, as in previous years, showed early and excellent autumn leaf coloration. We will attempt some trial propagations in 1978. One of our major goals in sweetgum breeding is a fruitless cultivar, and this selection has not yet reached sexual maturity, at 8 years of age.

Liriodendron

The carotenoid pigments in the petals of *L. tulipifera* and *L. chinense* were identified for the first time. The broad orange band in American tuliptree flowers was largely beta-carotene and the major xanthophyll in the petal was lutein-5,6-epoxide. These pigments, as well as lutein and alpha-carotene-5,6-epoxide, were present in both species. Five unidentified xanthophylls were found in trace amounts in *L.* tulipifera, while *L. chinense* contained 10. It will be most interesting to observe the color and pigment pattern of the flowers of the interspecific hybrids (now 7 years old) when they become sexually mature.

Magnolia

In 1977, the first of our inter-subgeneric magnolia hybrids flowered for the first time. The single seedling was a 1971 cross of *M. grandiflora* (as female) with *M. acuminata* var. *subcordata* (=*M. cordata*). The hybrid is definitely evergreen, having retained all of its leaves even during the winter of 1976-77. However, as we rather warily had predicted, the flowers did not inherit enough carotenoid yellow pigments from the male parent to significantly influence the color of the tepals. Still, this plant is the first inter-subgeneric hybrid known in *Magnolia*, and we will continue to observe the plant and study its genetic, cytological, and morphological characteristics.

The carotenoid pigments in the flower petals of *Magnolia* species were identified for the first time. The major pigment was the xanthophyll lutein-5,6-epoxide and, in *M. acuminata*, lutein, beta-carotene, and alpha-carotene-5,6-epoxide were also present. Trace amounts of some of these carotenoids were also found in the tepals of *M. denudata*, *M. grandiflora*, *M. virginiana*, and the red-flowered *M. sprengeri* 'Diva'. Thus, it is likely that only yellow shades may be produced by the carotenoids alone, although some orange colors may result from a blend of the plastid carotenoids and the cell-sap anthocyanin pigments. We will have to wait for our hybrids of *M. acuminata* x 'Diva' to flower to determine this possibility.

Quercus

A number of years ago, we grew a small progeny resulting from open pollination of a natural hybrid between willow oak (*Quercus phellos*) and pin oak (*Q. palustris*). One of these seedlings has leaves that are almost indistinguishable from willow oak but that turn an attractive yellow-red in the fall. Despite the obvious difficulties, we will attempt to root cuttings of this selection and continue observations on fall color.

Rhododendron

The major carotenoid pigments in the yellow flower petals (corollas) of various species and cultivars of Rhododendron were identified for the first time. They were beta-carotene, prolycopene, alpha-carotene-5,6-epoxide, lutein, and lutein-5,6-epoxide. Lycopene was a major constituent in only one hybrid of dubious parentage. Several undetermined xanthophylls were present in trace amounts. Rhododendrons whose petals contained the flavonol gossypetin 6-glucoside also contained carotenoid pigments. Yellow-flowered deciduous azaleas contained a greater number of trace xanthophylls, but otherwise there were no significant differences in major carotenoids between various groups in the genus. This study was an adjunct to the breeding program to develop yellow-flowered evergreen azaleas. Analyses of several advanced generation evergreen segregates indicated that the number and concentration of carotenoids were insufficient to cause significant "yellowness" in the corolla and that what carotenoids were present were frequently masked by chlorophylls.

A new azaleadendron, obtained by crossing R. yakusimanum x 'Adrian Koster', produced excellent yellow flowers and has been selected for further propagation to test its performance outdoors.

Robinia

With increased emphasis on coal as a domestic solution to the energy crisis, strip-mining activity has been accelerated. Renewed interest has been shown in Robinia pseudoacacia (black locust) because of its past successful use in strip-mine spoil-bank reclamation. In an earlier paper (F. S. Santamour, Jr., Amer. Hort. Mag. 49(2): 64-66, 1970) the creation of a seed orchard at the National Arboretum for the production of superior black locust trees was discussed. Preliminary tests in western Maryland in 1971-2 confirmed the growth superiority of seedlings produced from the seed orchard.

The basis of this seed orchard were clonal selections made by the USDA Soil Conservation Service in the 1940's. Of the five clones under test at the National Arboretum, 'Shipmast' was eliminated in 1970 because of its poor form and growth rate. Following thinning of the planting in 1970, another clone proved to be very susceptible to the locust borer, and this clone was also eliminated.

In the fall of 1976, we harvested seed from the remaining three clones and have offered it to researchers through our general seed distribution program and by special distribution. The high degree of self-compatability insures that the seed is the product of crossing among the three select clones and the progeny should represent a highly significant improvement in growth, form (single-trunked), and borer resistance as compared to common black locust.

We are now re-propagating the three clones for the establishment of a better-designed seed orchard at our Beltsville test site ("Shady Acres"). The continual harvest of seed from the original planting will assure a good supply of seed until the new orchard comes into production.

Special Items

A Symposium on "The Current State of The Art of Dutch Elm Disease Control" was held at the National Arboretum on November 9 and 10, 1977. Sponsored by the National Arborist Association, the Symposium brought together 21 of the leading researchers and practitioners on Dutch elm disease from the United States and Canada. Dr. Santamour was co-organizer of this Symposium, presented the summary paper, and served as chief editor of the Proceedings.

In his capacity as National Technical Advisor for Nursery Crops Research, Dr. Santamour participated in program reviews at the Nursery Crops Research Laboratory in Delaware, Ohio, and at the new shelterbelt breeding project in Mandan, North Dakota. Tree breeding is being de-emphasized at Delaware in favor of more research on stress physiology. The Mandan project was initiated to meet a great need for more reliable shelterbelt trees in the Northern Plains.

C. Cytogenetics, Breeding, and Evaluation of Ornamental Shrubs

Hibiscus

Triploid *Hibiscus syriacus* cultivars, which do not produce seed and have continuous flowering from early summer to autumn, are destined to replace the standard cultivars. After further evaluation of triploid seedling selections, one with white flowers and a prominent red eye spot has been propagated for stock increase distribution to cooperators. Four other seedling selections were propagated for evaluation distribution.

Lagerstroemia

The major research emphasis continues to be mildew resistance. The advanced seedling generations of *L. indica* x *L. fauriei* have produced seedlings that combine mildew tolerance with extended flower color range. Although the seedlings appear promising during the initial flowering, it will be several years until the trunk bark characteristics can be appraised. The 1,188 F_2 and F_3 generation seedling selections exhibit more intense flower color with a wide range of growth habits from dwarfs to intermediate and tree types. Two selections have been stock increased for introduction in 1978; a third has been propagated for a stock increase distribution to cooperating wholesale propagation nurseries. The colchicine treated plants have been further evaluated to isolate potential polyploid parental clones for the production of sterile triploid plants.

Malus

The fire blight resistant plants isolated by artificial inoculation of crosses, species, and cultivar seedling populations have made good field growth. A few have flowered but it will be several additional years before these can be critically evaluated for ornamental merit and multiple disease resistance. An additional 21 species and cultivars have been added to the plant collection.

Pyracantha

Two fire blight and scab resistant selections have been stock increased by cooperating nurseries for introduction in 1978. The severe winter conditions, both cold temperatures and ground frost, of 1977 provided a vigorous hardiness test of all advanced generation seedlings. Many were severely damaged and later rogued from the field, while others were relatively untouched. From the hardy plants, 15 selections that combine the flower, fruit, and growth characteristics of three or four species have been propagated for further field evaluation. All hybridization this season was concentrated on dwarf F_2 selections in an attempt to produce disease resistant, compact plants adaptable to residential landscapes. F_2 populations of intergeneric hybrids have been further evaluated in an attempt to isolate genetic recombinants, but relatively few are of ornamental merit. Nine F_2 and F_3 interspecific dwarf populations (4,035 plants) were grown to determine possible inheritance of the dwarf characteristic.

Syringa

The Syringa stock plants have developed into specimens with adequate flower inflorescences to permit extensive hybridization of *S. oblata* and *S. x hyacinthiflora* cultivars with mildew resistant and heat tolerant species and cultivars. Of the 568 attempted interspecific crosses, seed was harvested from 178. Tissue and anther culture studies have been initiated in an attempt to expedite breeding research. An additional 47 species and cultivars have been added to the plant collection.

Viburnum

The advanced generation populations of dwarf and compact growth habit plants have made good growth. The large flowered, low growth habit *V. plicatum tomentosum* F_2 selection has been stock increased by cooperators for introduction in 1978. A vigorous, tree-like, *V. sieboldii*, F_2 selection with heavy foliage that does not sunburn, has been initially propagated for evaluation distribution.

Cooperative Program

The support of cooperators in the evaluation and stock increase programs has provided the key to successful introduction of new cultivars resulting from the National Arboretum research programs. The evaluation cooperators have provided a critical appraisal of the ornamental and commercial potential of selections, while the stock increase cooperators have propagated large numbers of plants prior to release and introduction of new cultivars. The combined efforts of the two cooperative programs expedite introduction which could not be achieved independently by the National Arboretum. In 1977, 441 plants of 25 selections (1 Betula, 4 Camellia, 9 Hibiscus, 2 Ilex, 1 Magnolia, 4 Platanus, and 4 Ulmus) were distributed to 33 domestic and foreign cooperators for evaluation.

D. Breeding and Cytogenetics of Woody and Herbaceous Ornamentals

Field and greenhouse areas were expanded at Glenn Dale for the evaluation of clonal and seedling imported introductions (Plant Introduction Series) for genetic segregation of desirable phenotypes, for multiple testing under a range of climatic conditions.

Camellia

During the 1976-77 season, 2,587 controlled crosses were made following objectives toward floral fragrance, greater cold hardiness, and new plant and flower forms. This resulted in 498 new hybrid seedlings. With the 1977-78 season approximately 80 percent completed 2,375 controlled crosses have been made with no estimate as yet regarding capsule development.

Breeding for floral fragrance involved backcross and second generation crosses utilizing 'Fragrant Pink Improved', a fertile cytochimera developed in this breeding program - the first series of 1,322 hybrids flowered during the 1976 and 1977 seasons - elite selections have been made and are being propagated for stock increase - two selections were distributed in 1977 for stock increase. Breeding for cold hardiness has involved a series of interspecific hybrids of C. sasanqua and C. hiemalis crossed with C. oleifera, several of which have displayed flowers of commercial quality - three selections were distributed in 1977 for stock increase. Breeding for greater heat and sun tolerance has involved interspecific hybrids involving C. japonica with C. hongkongensis and C. granthamiana - one C. hongkongensis hybrid selection was distributed in 1977 for stock increase.

The history and development of a series of genetic dwarf interspecific hybrids has been documented. A study of the phenological and cytological behavior of a spontaneous mutation of C. x williamsii 'November Pink' has been documented. Cytochimera 'Fragrant Pink Improved' (2-4-4) composition has been stabilized by inducing adventitious buds to develop a fully tetraploid shoot of 4-4-4 composition.

Pollen morphology studies on 20 camellia species show distinctive phenological characteristics which may provide a valuable tool for the cytological separation of species.

Franklinia

There was a complete lack of germination of hybrid seed from Franklinia x Camellia japonica crosses. Seeds were stratified in an unheated pit house during the 1976-77 winter season. Failure may have been due to abnormally low temperatures - an assumption supported by the fact that open-pollinated seeds of Franklinia in the same facility also failed to germinate. Presently, 11 seed capsules are maturing of C. oleifera x Franklinia and 6 capsules of Gordonia chrysandra x Franklinia in our greenhouse facilities. We have no assurances regarding the final product resulting from these crosses. Past intergeneric crosses in Theaceae have resulted in (1) intergeneric hybrids of good plant vigor from crosses of Tutcheria x Camellia (2) hybrids of poor vigor and survival from C. hongkongensis x Franklinia, and (3) production of haploid C. sasanqua plants from crosses of C. sasanqua x Franklinia. Any intergeneric hybrids which may develop would be of great academic interest and may have considerable commercial potential.

A series of young Franklinia seedlings were treated with colchicine in an effort to induce polyploidy - several of these have displayed abnormal foliage for two seasons. The plants will be large enough this coming year for rooting cuttings for cytological examination. If chromosome changes are observed, they will be field planted for flowering and used in subsequent crosses with other theaceae genera.

Iris kaempferi

During the summer of 1977, 211 controlled crosses between the Japanese and German Iris resulted in four plants, but two of these died. The two remaining plants, which are extremely slow growing compared with normal plants, have reached the 3-inch pot size and exhibit intermediate leaf and plant characters. Flower description records were compiled during the 1977 season on a series of 315 second generation progeny. During the 1977 season a new Iris test block was established with a planting of 2,400 third generation progeny. Growth has been excellent and there should be substantial flowering during the 1978 season. Aseptic culture of exercised primordial flower scapes has resulted in root formation, but as yet no shoot development. A screening program is underway for more successful media preparations.

Amaryllidaceae

Lycoris. During the 1977 season, 517 controlled crosses were made which resulted in 210 seeds. From these, 159 seedlings have been successfully germinated to date. Two-thirds of the young hybrids have

been examined cytologically, and chromosome counts have ranged from 16 to 66 chromosomes. The results thus far disclose two types of chromosomes among the various hybrids. It would appear that two short chromosomes possess the same general genetic material as one long chromosome. Chromosomes of an intermediate composition were found associated with hybrids involving L. chinensis. Aseptic culture of pedicels and leaf explants are underway, directed toward a screening program for more successful media preparations.

Other Amaryllids - Intergeneric hybridization and cytological studies among six genera within the family reveal the presence of sterility barriers which appear to be associated with differences in chromosome numbers and morphology. The first Amaryllid interspecific hybrids made two years ago came into bloom during the 1977 season.

Paramongaia interspecific crosses have resulted in six well formed seed capsules.

Rhododendron japonicum - An effective screening method was developed to predict flower colors among segregating seedling populations. Two breeding lines have been extended to the F_4 generation.

Pyrus - Primarily P. calleryana. A narrow, columnar selection, under evaluation since 1969, was named 'Whitehouse'. The cultivar develops a strong central leader and fine, profuse, upward arching branches. It exhibits abundant spring flowering, glossy green leaves in summer, and dark red-purple to crimson fall coloration. It has shown natural resistance to fire blight, Erwinia amylovora, and has proven itself under field inoculation tests. The tree's narrow crown makes it ideal for shade tree purposes where space is limited. Distribution was begun during the winter of 1977-78.

Malus - An unnamed flowering crab selection, under evaluation since 1967, was distributed during the spring of 1977 for cooperator evaluation. Plant habit and fruiting is similar to the cultivar 'Crittenden' (patented), except the abundant fruits are dark red instead of orange-red.

Hypericum, Paeonia, Potentilla, and Yucca - Documented collections are being assembled and evaluated for future breeding programs encompassing these ornamental genera. The breeding potential of these genera, new to the program, will be made for their replacement value of existing programs which will eventually be terminated. Present breeding stock collections are as follows: Hypericum, 96 accessions, 62 species; Paeonia, 23 accessions, 13 species; Potentilla, 131 accessions, 76 species; Yucca, 114 accessions, 3 species.

Plant Exploration in Japan

Dr. Ackerman undertook a plant collecting trip to Japan from March 4 to April 21, 1977. This exploration, sponsored by the USDA plant exploration program, was designed to observe and collect plants and scions of *Camellia*, related genera, and other ornamental species in the wild and under cultivation. Particularly, to collect new genetic material of *C. lutchuensis* and other minor species of value to the breeding programs of the National Arboretum. In addition, to contact Japanese research scientists, especially those working with *Camellia*, to observe their operations, exchange information, and arrange for future cooperative studies. Also, to contact Japanese camellia growers and nurserymen, collect plant materials, and arrange for plant exchange.

Dr. Ackerman traveled extensively from Okinawa through the southern Japanese Islands to northern Honshu. Plant materials were collected from wild native populations of *C. lutchuensis*, *C. sasanqua*, *C. japonica*, *C. rusticana*, and six related genera from six regions: Okinawa Forestry Preserve areas of Meigiyama Mountain and the Kunigami-son region, Itsukaichi-cho region of Hiroshima Pref., Mt. Minhara region of Oshima Island, the Higo-Sanmyaku mountains of Toyama Pref., the Da-Sanchi mountains of Gifu Pref., and the Echigo Anmyaku mountains of Niigata Pref. Collections were also made of cultivated forms from 24 nurseries and 12 botanical gardens and parks.

A total of 340 accessions were made including: 14 *Camellia* species, four species of which had not previously been introduced into the United States and one species previously introduced, but lost; 14 species of six related genera including one genera and two species not previously introduced; and representatives of 16 other ornamental genera.

Visitations included faculty members of eight universities and experiment stations, where Dr. Ackerman toured laboratory and greenhouse facilities and discussed progress being made in *Camellia* breeding and research in Japan and the United States. In addition, Dr. Ackerman was invitational speaker at four graduate student seminars and three camellia society banquets. He also accepted an invitation by the Japan Camellia Society and Kodanshu Publishing Co., co-sponsors of the Encyclopedia of Camellia, for the writing of a book chapter on his polyploid research.

Invitational Papers and Presentations (W. L. Ackerman) - 1977

By invitation, during a 7-week plant exploration trip in Japan (March 4 to April 21), invitations were extended and accepted for the following presentations. Subject, "Camellia Research in America" - scope of talk varied with audience and interpreter's command of English.

--March 6 - Graduate Student Seminar. Host, Dr. Naotoshi Hakodo, Faculty of Agriculture, Tokyo University, Fuchu-City, Tokyo.

--March 14 - Graduate Student Seminar. Host, Dr. Shunpei Uemoto, Faculty of Agriculture, Kyushu University, Higashi-ku, Fukuoka.

--March 15 - Kurume Camellia Society. Host, Mr. Hifa Satomi, Kurume City.

--March 17 - Graduate Student Seminar. Hosts, Drs. M. Tanaka and K. Kondo, Department of Environmental Sciences, Faculty of Integrated Arts & Sciences, Hiroshima University, Higashisenda-machi, Hiroshima.

--March 20 - Kobe Camellia Society. Host, Mr. Yoshiski Andoh, Nadaka, Kobe City.

--March 25 - Japan Camellia Society. Hosts, Messrs. S. Nagaoka and K. Odaira, Directors, J.C.S., Tokyo.

--April 10 - Graduate Student Seminar. Host, Dr. Kaoru Hagiya, Department of Horticulture, Niigata University, Niigata City.

The Plant Introduction Station at Glenn Dale, Maryland

The Plant Introduction Station is now a part of the U.S. National Arboretum. The 70-acre station is staffed with 12 research scientists and 3 quarantine persons. Their primary responsibilities are to receive quarantine plant materials for the USDA which are imported from all countries of the world. Plants are observed for all types of pests including insects, fungi, bacteria, snails, and nematodes. They are tested, using several techniques, for a broad range of viroids, viruses, and mycoplasmas. Items found free of all pests are propagated and distributed to breeders throughout the United States. An average of 450 fruit, 1,800 ornamental, and 100 miscellaneous items were distributed to some 395 horticulturists, plant breeders, pathologists, biochemists, and agronomists during each of the past 5 years.

Another major activity at this station involves detailed studies on viruses from fruit and woody ornamental plants. Viruses are extracted, purified, studied chemically and physically, and identified using host range, particle structure, and serology as the main criteria. During the past year, a virus disease of Ampelamus, pear, and several strains of cucumber mosaic virus were studied in detail.

A new catagory of sub-microscopic infectious disease-modifying agent, much smaller than a virus, was discovered in 1976. It exists only in the presence of cucumber mosaic virus. In cooperative studies with Dr. J. M. Kaper, Beltsville, and H. E. Waterworth at Glenn Dale, we now know that this tiny piece of ribonucleic acid was the cause of a multi-million dollar loss of the tomato crops in France in recent years. (For details, see citation in Science by Kaper and Waterworth.) It has been found in several other crops in the United States but is less destructive than in tomatoes. A recently discovered and highly unique characteristic of this RNA is that under specific conditions, it protects plants from infection. Studies on the effect of this RNA on other major crops continue.

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The following Program Aids (PA) and Home and Garden Bulletins (HG) were written or revised by Erik A. Neumann:

--PA #309 - The United States National Arboretum
--PA #890 - Camellias at the National Arboretum
--PA #1158 - The National Bonsai Collection
--HG #135 - Growing Flowering Crabapples
--HG #120 - Growing Boxwoods
--HG #88 - Growing the Flowering Dogwood
--HG #130 - Growing Hollies
--HG #192 - Transplanting Ornamental Trees and Shrubs
--HG #117 - Trees for Shade and Beauty
--HG #205 - Selecting and Growing Shade Trees
--HG #181 - Shrubs, Vines and Trees for Summer Color
--HG #142 - Selecting Shrubs For Shady Areas